



# Building a Climate-Smart Healthcare System For California

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## About the Institute

Since 1990, the Bay Area Council Economic Institute has been the leading think tank focused on the economic and policy issues facing the San Francisco/Silicon Valley Bay Area, one of the most dynamic regions in the United States and the world's leading center for technology and innovation. A valued forum for stakeholder engagement and a respected source of information and fact-based analysis, the Institute is a trusted partner and adviser to both business leaders and government officials. Through its economic and policy research and its many partnerships, the Institute addresses major factors impacting the competitiveness, economic development and quality of life of the region and the state, including infrastructure, globalization, science and technology, and health policy. It is guided by a Board of Trustees drawn from influential leaders in the corporate, academic, non-profit, and government sectors. The Institute is housed at and supported by the Bay Area Council, a public policy organization that includes hundreds of the region's largest employers and is committed to keeping the Bay Area the world's most competitive economy and best place to live. The Institute also supports and manages the Bay Area Science and Innovation Consortium (BASIC), a partnership of Northern California's leading scientific research laboratories and thinkers.



Climate change remains a serious threat to human health, and healthcare organizations in California, across the U.S., and globally can be catalysts in creating a climate-smart future.

The healthcare sector is responsible for 10 percent of greenhouse gas emissions in the United States, yet by reducing our emissions, we can bring the state of California back under the level of emissions we saw in 1990. How will we do that? By working together to reduce emissions through efforts such as activating more solar and wind energy onsite and offsite, improving ventilation in our hospitals, and sourcing more responsibly the food we serve our patients and employees. These actions also improve the energy efficiency in our buildings, which help reduce operating expenses. Beyond being good for the climate, these efforts make good business sense.

While the specific steps and recommendations in this report – and many of the case studies included – focus on the state of California, the learnings are applicable to healthcare systems across the nation and world. California has been an active leader on climate change, initiating actions necessary to slow the rate of climate change and to help businesses adapt to the consequences.

The Bay Area Council leadership is aligned around the mission to promote the best possible health for everyone living in California, the United States and around the world. This report details some important information that can spread best practices beyond the Golden State.

The California legislature has set extremely ambitious goals for the reduction of greenhouse gases, and Governor Jerry Brown has helped lead the international community's response to this shared climate challenge. I urge my peers within the healthcare industry to continue to work in partnership with policymakers to take private sector actions and craft public sector policies that provide actionable leadership on this urgent climate challenge.



— Bernard J. Tyson, Chairman and CEO, Kaiser Permanente

## Executive Summary

California's widely varying weather, coastal location, and large population mean the state is feeling the effects of climate change sooner and more severely than other regions. Severe heat waves, prolonged drought, uncontrollable wildfires, increased flooding, poor air quality, invasive species, and increased disease have already begun to impact every aspect of life in the state. The California wildfires of 2017 were the deadliest and costliest in the state's history, claiming forty-two lives, destroying or damaging 32,000 homes, and costing nearly \$12 billion.

California has set extremely ambitious greenhouse gas (GHG) emission reduction targets. The state has goals to reduce greenhouse gas emissions to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050, but despite recent progress, current simulations show the state's emissions increasing around the year 2030, and continuing up from there. In order to reduce the health

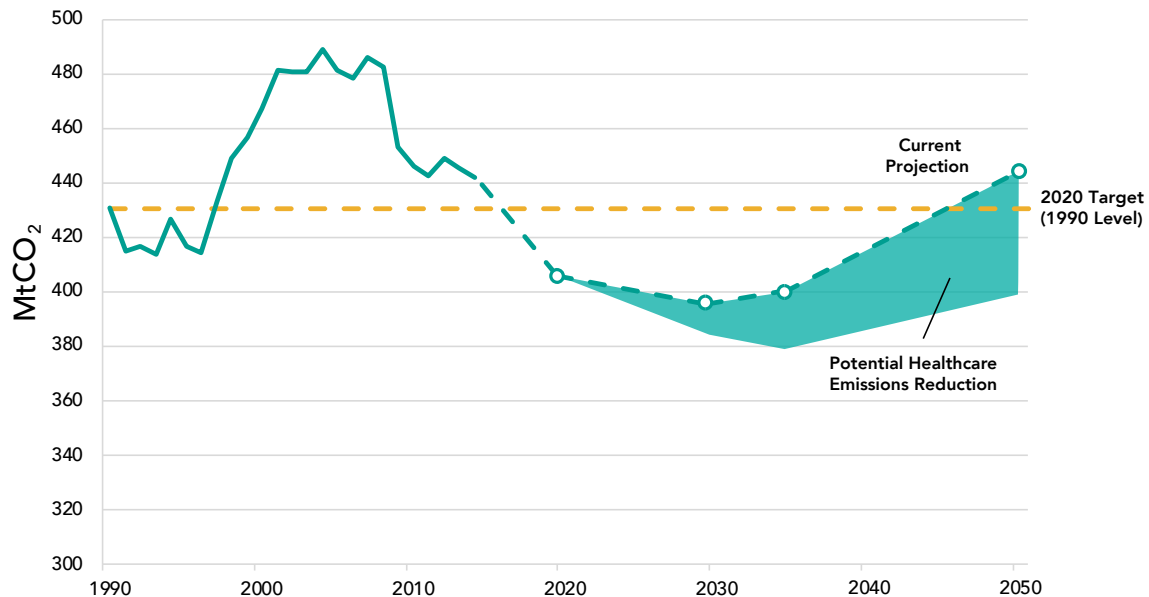
impacts of climate change, every business sector must take responsibility, but the massive size and mission-driven nature of the healthcare sector provide even greater impetus for action.

There is an increasingly wide range of proven climate-smart technologies and interventions that can be employed to mitigate emissions in hospitals. A number of California hospitals have established themselves as national leaders in their efforts to reduce their carbon footprints to improve the safety and well-being of their communities. If all hospitals in California adopted the climate-smart strategies being implemented by these leading institutions, the sector would be a key contributor to meeting the state's GHG emission reduction goals, protecting the health of California communities, and supporting the transition to a low-carbon economy.

### Key Findings:

- **In California, healthcare spending totaled \$292 billion in 2016, representing 13 percent of the state's economy** – If California's healthcare sector were a state, it would have the 23<sup>rd</sup> largest economy in the country, placing it above states like Connecticut, Louisiana, and Oregon.
- **Healthcare emissions are responsible for almost 10 percent of all emissions in the U.S., and likely a similar share in California** – Health sector emissions are growing at a rapid pace, increasing 28 percent between 2003 and 2013, while overall emissions for the same period declined by 6 percent.
- **Hospital care represents the single largest share of healthcare emissions at 36 percent, but also the biggest opportunity** – Hospitals are energy-intensive facilities by their very nature, but a host of new technologies and interventions make transitioning to a low-carbon future possible.
- **In 2015 alone, California's health sector was responsible for between \$1.6 and \$9.5 billion in long-term damage as a result of greenhouse gas emissions** – Additionally, the damages nationwide to human health as a result of health sector emissions are equivalent to the 44,000 to 98,000 deaths attributed to preventable medical errors each year.
- **Healthcare will be essential to meeting California's ambitious climate goals** – As one of the largest and most energy intensive industries in the state, healthcare has the ability to make an immense contribution in the race to meet ambitious climate goals.

## Healthcare Can Halt Growth in California Emissions and Contribute to Meeting Ambitious Climate Goals



Note: Healthcare has the potential to reduce CA emissions by almost 10 percent, which could prove crucial to meeting the state's 2020 target.

Source: California Air Resources Board; Environmental Impacts of the U.S. Healthcare System and Effects on Public Health. PLoS ONE

Analysis: Bay Area Council Economic Institute

The chart above demonstrates the total contribution the healthcare sector could make in the race to meet California's goals. To help sector leaders and policymakers with their efforts to combat climate change, this report examines why the healthcare sector must act, what the extent of the sector's emissions are, and how investing in climate-smart strategies can provide health and often financial benefits. The report showcases some of the major steps that California hospitals have already taken to redesign their facilities and implement practices to address climate change. It then concludes with a list of recommendations for concerted private and public-sector action.

In order for hospitals to make the dramatic changes needed to build a climate-smart healthcare system, state policies and regulations must support climate-smart healthcare strategies. Even in California, a national leader in environmental policy, there are policies and

regulations that limit the healthcare sector's ability to act. Policymakers and regulatory bodies need to understand how healthcare's needs and regulations uniquely impact their ability to implement climate-smart interventions, and healthcare executives need to advocate for the integration of healthcare into climate and energy policy and climate considerations into health policy. With the right combination of sector action and policy changes, the healthcare sector can become a considerable positive force to help the state meet and exceed its climate goals, direct billions of dollars into the low carbon economy, and serve as a model to be replicated in other states and subnational entities around the world.

To help sector leaders and policymakers with their efforts to combat climate change, the analysis in this report makes the case to invest in climate-smart health systems and details ways to achieve that goal.



# Sector and Policy Recommendations:

The below list of recommendations was developed with the intention of guiding concerted private and public-sector action. To make the healthcare sector more sustainable, it will require significant coordination between the healthcare sector, its upstream and downstream suppliers, and policymakers on a local, state, and national level.

## Sector Recommendations

**Perform energy audits of facilities and implement a continuous commissioning program to reduce energy consumption.** Operating buildings as designed and immediately addressing suboptimal conditions and settings presents an opportunity to reduce GHG emissions while positively impacting the bottom line. A continuous commissioning capability that combines real-time fault detection with algorithms that identify high payback actions will quickly resolve operating problems, improve comfort, and optimize energy use.

**Invest in renewable energy.** The combustion of fossil fuels leads to significant adverse health impacts and hospitals have the responsibility to protect public health. Renewable energy sources are becoming cost competitive with fossil fuels and eliminate the risks of energy cost volatility. California has strong policy support and incentives for on-site and off-site investments in renewable energy.

**Advance the transition to a low-carbon transportation system for cleaner air and healthier communities.**

Hospitals should follow a four-pronged approach:

- A. Incentivize alternative transportation modes for employees.
- B. Convert fleet vehicles to low/zero emission fuels.
- C. Provide electric vehicle (EV) charging infrastructure.
- D. Address supply chain impacts through adopting idle-reduction practices, consolidating deliveries, and incorporating EPA SmartWay criteria in vendor selection.

**Purchase local and sustainably-grown and produced food** to reduce climate impacts from industrial agriculture production methods and to support the growth of a strong, regional food economy. As large-volume buyers, hospitals can make purchasing commitments to local producers that allow them to expand operations and invest in new processing equipment. Hospitals should instruct their GPOs to source local food and ensure it is clearly labeled as such in catalogs and ordering forms.

**Focus on waste reduction** as the key strategy to reduce environmental impact and associated costs. Look for opportunities to switch from disposable to reusable options across the system – sharps containers, sterilization cases, totes, isolation gowns. Reduce pre- and post-consumer food waste for savings on food purchases and significant GHG emissions reduction. Regular staff training on waste segregation is critical for success.

**Implement an environmentally preferable purchasing policy** and embed environmental attribute considerations in purchasing standards, specifications, decisions, contracting, and requests for proposal (RFP) to prioritize environmentally preferable, low-carbon products and services.

**Conserve water** and save money on water and sewer bills. Start with a water audit to analyze the facility for leaks and identify opportunities to:

- A. Save water in facilities (e.g. maintain boiler steam traps, capture condensate on cooling towers).
- B. Install water-efficient equipment (e.g. low-flow, sensor-activated faucets).
- C. Reduce water use for irrigation (e.g. xeriscape landscaping, rainwater collection).

**Advocate for climate-smart public policies.** Use healthcare's trusted voice to educate policymakers and the public that strong climate mitigation and resilience policies are good for both public health and the control of health care costs.

## Policy Recommendations

**Adopt energy-saving opportunities from national standards into California code.** For some years, California requirements for healthcare infrastructure – largely set by the Office of Statewide Health Planning and Development (OSHPD) – have been substantially more restrictive than national and other state standards. National standards contain a number of opportunities for energy savings, which should be adopted into California codes and that should be considered.

— **Develop a leadership position in energy-conscious health care ventilation through pilot projects and research.** Hospital ventilation standards present a significant opportunity for energy and carbon reduction and current California standards exceed national requirements. The California Energy Commission (CEC) has begun an advanced HVAC demonstration project, and should expand this opportunity, taking a role of national leadership in introducing new technology into the national standards paradigm.

**Design streamlined approval processes for proven technologies that have demonstrated significant energy-savings.** The time and money imposed by permitting is significant and makes it difficult for hospitals, especially smaller hospitals, to do even simple energy-saving upgrades like LED retrofitting. Streamlined approvals processes should be implemented for projects such as LED retrofitting, the conversion of exhaust fans to low voltage units, the replacement of inefficient motors with efficient ones, and the replacement of water savings devices.

**Create an advocate in the Attorney General's Office for enforcement of the Solar Rights Act (Code 658).** The Solar Rights Act is largely ignored by municipalities and many health systems have had significant pushback when trying to install solar projects. Health systems are unlikely to complain to a municipality for fear of repercussions. A Solar Rights Act Advocate to whom developers and customers could file complaints could facilitate the installation of additional solar at an increased pace.

**Maintain and scale state support for the Self-Generation Incentive Program (SGIP).** This program makes it economically viable for health systems to install battery storage, and these rebates should be maintained until large-scale battery storage becomes more competitive.

**Continue state funding to support the transition to electric vehicles and renewable fuels,** particularly for development of needed infrastructure. Include social equity measures to promote access to alternative transportation and vocational opportunities related to new transit technologies.

**Create policy incentives to support shifts toward reduced meat and dairy production and consumption.** Examples include: increasing research and support for transitioning animal agriculture farms to integrated systems or to the production of nitrogen-fixing protein alternatives such as organic legumes, or implementing carbon tax policies that account for livestock emissions.

**Adopt farmland conservation efforts** that include access and affordability strategies, to not only protect farmland, but to protect the benefits that the state's small-scale, sustainable farmers provide and to ensure their livelihoods.

**Examine ways to encourage municipalities – especially medium and small municipalities – to commit to Zero Waste Principles.** The majority of hospital waste is non-regulated and is therefore handled by municipal providers just like residential waste. Several major California cities, including San Francisco and Los Angeles, have committed to Zero Waste Principles in cooperation with refuse and recycling service providers. Structures to encourage and even incentivize smaller municipalities to commit to Zero Waste could go a long way in reducing a hospital's footprint.

**Support a sustainable water supply** through conservation, efficiency, and infrastructure maintenance. Ensure full implementation of the Sustainable Groundwater Management Act. Provide adequate funding for smart water management projects and programs, including funds to provide safe and affordable drinking water to all Californians.







# Healthcare and Climate Change

Global climate and human health are inextricably linked. Heat waves, droughts, extreme weather events, increased air pollutants, an increase in disease-carrying vectors such as mosquitoes, and the displacement of populations all have tremendous negative health effects, with disproportionately high impacts on already impoverished communities. California's widely varying weather, coastal location, and large population mean the state will feel the effects of a warming world sooner and more severely than other regions.

California's 2017 wildfire season may be a window into the future. CalFire estimates over 1.2 million acres burned last year – a 112 percent increase over the previous year – with separate blazes breaking records for the largest and most costly fires in California history. Forty-two people died in the Northern California fires, 100,000 people were displaced, and two Sonoma County hospitals had to evacuate over 200 patients. Firestorms destroyed or damaged 32,000 homes, 4,300 businesses and more than 8,200 vehicles, boats, and other equipment. Total damages are currently nearing \$12 billion, according to the California Department of Insurance, exceeding total losses from the previous ten costliest fires combined.

## Why Healthcare?

Changes to our natural world brought on by climate change will have immense impacts on human populations in all corners of the globe. These impacts will not only create environmental and economic challenges, but also a public health challenge. In 2015, the Lancet Commission on Health and Climate Change found that human-driven climate change is on track to erase 50-plus years of progress in public health and represents a significant risk to human health going forward. The Commission went on to conclude that "Tackling climate change could be the greatest global health opportunity of the 21st century."<sup>1</sup>

The healthcare sector, with its mission to protect and improve the health and well-being of the population, is at the frontline of climate change, bearing the costs of increased diseases and more frequent, severe extreme weather events, while also being a key contributor to climate change. Health systems must minimize their contribution to the problem, and health professionals must play a greater role in driving awareness to the threats that climate change poses to public health.

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In the absence of comprehensive action, health systems across the world will have to manage the increased strain on personnel and resources, while facilities are repeatedly threatened by natural disasters. This will become even more difficult as climate change begins to take a toll on the economy, further diminishing resources. With more frequent extreme weather events, insurance, and government reimbursements for damages to facilities and operations are likely to be less and slower to materialize. Reduced resources will also make health insurance coverage expansions less likely and may even result in the scaling back of coverage and benefits. The health system has come together successfully in the past to fight health crises like polio, the flu, tobacco, and HIV/AIDS; climate change may be the biggest challenge yet.

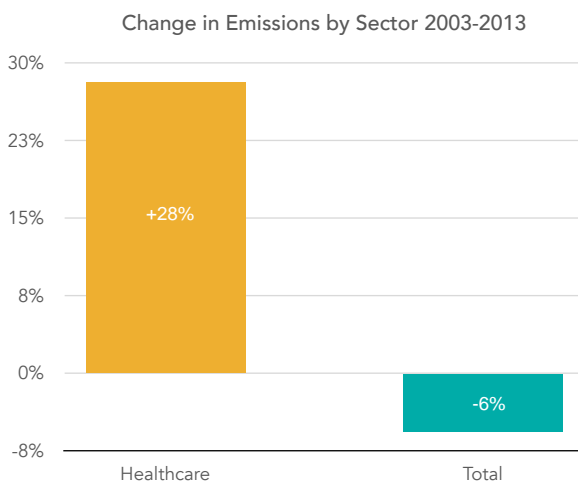
In coming together to build a climate-smart health system in California, the sector can make a significant difference in the fight against climate change, while safeguarding the health of the population and the resiliency of communities.

## Health System Emissions

U.S. healthcare spending reached \$3.4 trillion in 2016, accounting for almost one-fifth of the nation's economy, and is expected to grow to \$5.5 trillion by 2025. In California, healthcare spending totaled \$292 billion, representing 13 percent of the state's economy.<sup>2</sup> If California's healthcare sector were a state, it would have the 23<sup>rd</sup> largest economy in the country, placing it above states like Connecticut, Louisiana, and Oregon.

Healthcare is one of the largest industries in the nation, and as such, generates a large share of the nation's total emissions. It is estimated that the healthcare sector is responsible for 9.8 percent of all emissions in the U.S. in 2013 – equivalent to 655 million metric tons of CO<sub>2</sub>.<sup>3</sup> As healthcare costs have steadily increased, so too have the sector's emissions. From 2003 to 2013, health sector emissions increased by 28 percent nationwide. Overall emissions for the same period decreased by 5.7 percent.

Health sector emissions are not just generally contributing to global warming and climate change. The emissions directly impact the lives of millions of Americans every day, leading to increased rates of a range of diseases, from respiratory and heart disease to tick-borne illness to mental health problems. A 2016 study estimated that emissions from the healthcare sector resulted in a loss of life equivalent to the 44,000 to 98,000 deaths attributed to preventable medical errors each year.



Source: Environmental Impacts of the U.S. Healthcare System and Effects on Public Health, PLoS ONE  
Analysis: Bay Area Council Economic Institute

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## The Cost of Carbon

Climate change poses a clear threat to public health, food and water supplies, property, and the economy. To gauge the economic impacts of climate change damages, researchers have developed a common standard of measurement known as the "Social Cost of Carbon" (SC-CO<sub>2</sub>), which is now used by various federal agencies including the EPA. The SC-CO<sub>2</sub> attempts to estimate the long-term social and economic damages resulting from the emission of a metric ton of CO<sub>2</sub> in a given year.

The SC-CO<sub>2</sub> includes effects on public health, agricultural productivity, energy costs, and property damage associated with changing climate patterns.<sup>4</sup> It is important to note that this measurement is still being refined and many physical and economic damages have yet to be factored into the measure; however, it is used by a number of governments in coordination with climate scientists and economists around the world, and is accepted as a quality measure of economic impact in this area. The latest SC-CO<sub>2</sub> value released by the federal government in 2015 was \$37 per metric ton of CO<sub>2</sub>.<sup>5</sup> Other studies have estimated the SC-CO<sub>2</sub> to be as high as \$220 per metric ton of CO<sub>2</sub>, making the federal estimate a conservative one.<sup>6</sup>

Using the federal SC-CO<sub>2</sub> figure and a national estimate for the health sector's share of total emissions, the yearly damage caused by health sector emissions can be estimated. In 2015 alone, California's health sector was responsible for between \$1.6 and \$9.5 billion in long-term damage as a result of greenhouse gas emissions.

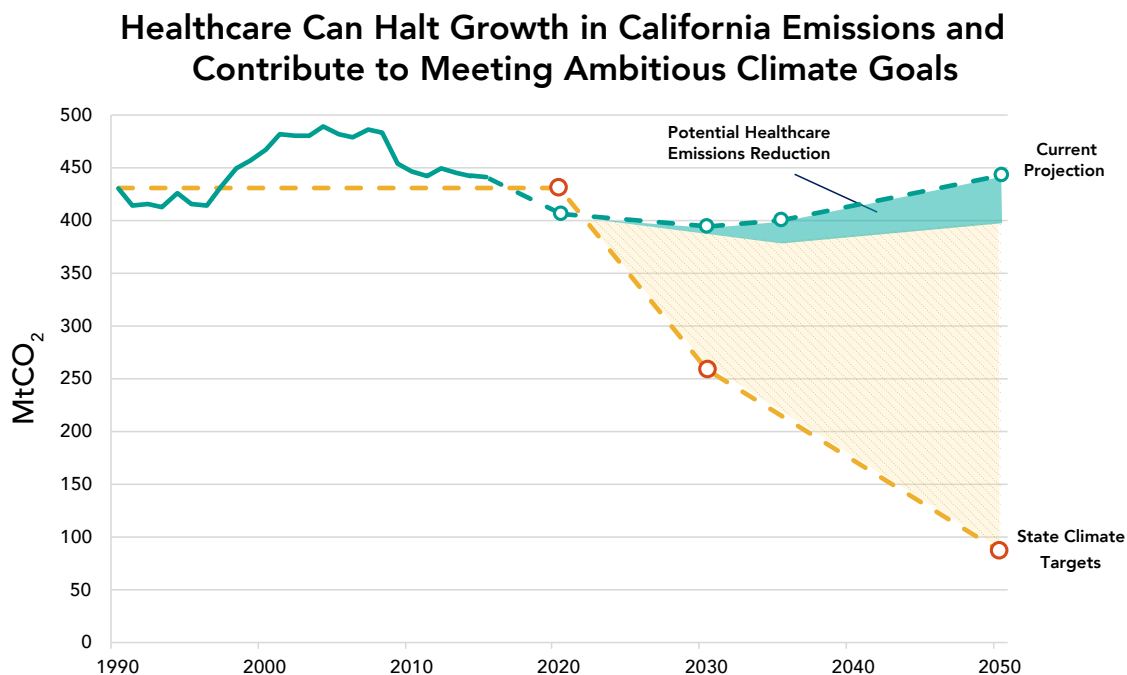
## Meeting California's Goals

California has set extremely ambitious emission reduction targets in its effort to lead the fight against climate change. The state has codified goals to reduce greenhouse gas emissions to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050. The state is also taking action against impacts that have already occurred or are soon to occur as a result of climate change, taking the necessary steps to protect public health, safety, the economy, and ensure communities can remain resilient into the future.

Despite the state's ambitious goals and recent progress, current simulations of future emissions have the state's emissions increasing around the year 2030 and continuing up from there. The chart below shows this simulated trajectory alongside the 2020, 2030, and 2050 goals. It is difficult to overstate the progress needed to

reach the 2030 and 2050 goals, and meeting them will require near-wholesale transformation of every sector of the economy, both public and private. Dramatic reductions in GHG emissions in the healthcare sector, which accounts for nearly 10% of state emissions (as shown in the green "wedge" below), are key to achieving California's goals.

California stands out as the nation's leader of innovative, environmentally sustainable policies, and has put in place regulations and initiatives to spur sector to act, including extending the state's Cap and Trade Program through 2030.<sup>7</sup> The state's health systems are working to implement climate-smart healthcare strategies to make their facilities and communities sustainable and resilient, providing examples of climate leadership for the nation and the world.



Note: Healthcare has the potential to reduce CA emissions by almost 10 percent, but all sectors must act to meet ambitious 2030 and 2050 targets.  
 Source: California Air Resources Board; Environmental Impacts of the U.S. Healthcare System and Effects on Public Health. PLoS ONE  
 Analysis: Bay Area Council Economic Institute



## Climate-Smart Healthcare

The term climate-smart healthcare was coined in a report that Health Care Without Harm jointly produced with the World Bank Group in 2017, titled [Climate-Smart Healthcare: Low-Carbon and Resilience Strategies for the Health Sector](#). Climate-smart healthcare recognizes the interconnection between mitigation, or “sustainability measures,” and resilience and adaptation initiatives. This report is focused on mitigation initiatives but it must be recognized that hospitals that reduce their carbon footprint are more resilient to climate impacts, and efforts to become more resilient often result in lowering a facility’s carbon footprint. For example, if a hospital is energy efficient and therefore uses less energy to run their operations, the hospital can stay open and provide longer services in a power outage related to an extreme weather event. The reverse is also true. If a hospital installs a micro-grid with a combined heat and power plant (CHP) to stay operational when the grid goes down, it will be able to produce electricity and heat more efficiently, using less energy and saving money.

A recent report completed by Health Care Without Harm and Pricewaterhouse Coopers, LLC, entitled [Safe Haven in the storm: Protecting lives and margins with climate-smart health care](#), examines the financial impacts of being ill-prepared for extreme weather, the fiscal and operational benefits of preparedness, and ways for smart executives to take action. Drawing from case studies, the paper analyzes billions of dollars in losses, such as suspension or closure of clinical services, supply chain disruptions, and research losses, to clearly show that a hospital’s bottom line and financial viability will increasingly be impacted by their action in climate mitigation, preparedness, and policy action. Other case studies demonstrate that upfront investments in mitigation and climate resiliency help to protect return on investment, manage risk, enhance reputation, and ensure coverage stability.

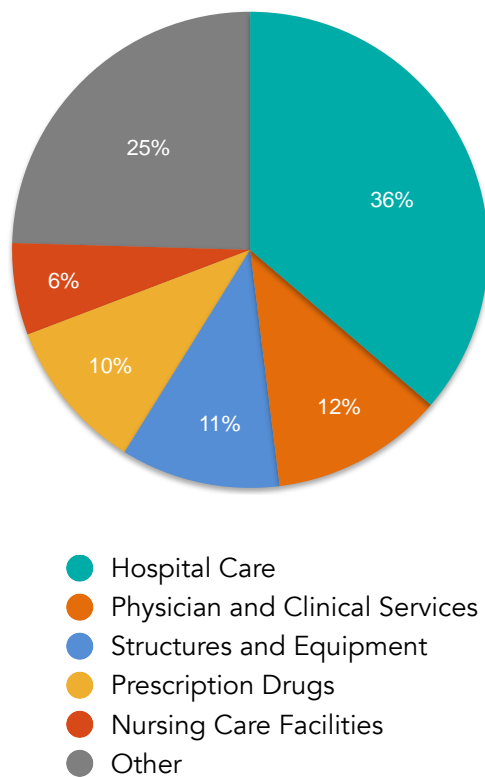


## Investing in Mitigation

There is an increasingly wide range of proven technologies and interventions that can be employed to mitigate emissions in the healthcare sector. A number of California hospitals have established themselves as national leaders in their efforts to reduce their carbon footprints to improve the safety and well-being of their communities. If all hospitals in California adopted the climate-smart strategies being implemented by these leading institutions, the sector would be a key contributor to meeting the state's GHG emission reduction goals, protecting health, and saving money.

In order for hospitals to make the dramatic changes needed, state policies and regulations must support climate-smart healthcare strategies. Even in California, a national leader in environmental policy, there are policies and regulations that limit the healthcare sector's ability to act. Policymakers and regulatory bodies need to understand how healthcare's needs and regulations uniquely impact their ability to implement climate-smart interventions; and healthcare executives need to advocate for the integration of healthcare into climate and energy policy and climate considerations into health policy.

**Health Sector Emissions by Category, 2013 (MtCO<sub>2</sub> Equivalent)**



## Creating Climate-Smart Hospitals

Hospital care represents the single largest share of U.S. health sector emissions, accounting for 36 percent of the sector's emissions in 2013.<sup>8</sup> This report examines strategies, interventions, and recommendations specifically for moving hospitals to a low-carbon future, as they represent the single biggest opportunity in the sector. The strategies were adapted from two reports: [Healthy Hospitals, Healthy Planet, Healthy People: Addressing climate change in health care settings](#) developed by Health Care Without Harm and the World Health Organization, and [Climate-Smart Healthcare: Low-Carbon and Resilience Strategies for the Health Sector](#) produced by Health Care Without Harm and the World Bank.

Sources: Environmental Impacts of the U.S. Healthcare System and Effects on Public Health, PLoS one  
Analysis: Bay Area Council Economic Institute

### *Improve the Energy Efficiency of Existing Facilities*

Improving the energy efficiency of existing facilities is one of the easiest and most cost-effective ways hospitals can significantly reduce their carbon footprint. Replacing older lighting fixtures, windows, electronics, and other appliances can go a long way in reducing carbon footprints. In particular, updating ventilation standards – which are responsible for between two-thirds and three-quarters of a hospital's energy use – could reduce total electricity and natural gas use significantly.<sup>9</sup>

A hospital uses 3–5 times as much energy as a 5-star hotel, with heating, ventilation, and air conditioning (HVAC) accounting for as much as three-quarters of that energy use. Strict ventilation standards and ventilation rates (the number of times interior air is exchanged for clean air per hour) are critical to infection prevention and ensuring the overall health of personnel, patients, and visitors. However, questions are being raised about both the strength of the evidence for the current high ventilation rates, and how broadly they are applied in healthcare. Increasing numbers of experts suspect the 85–90 percent of hospital space, which is designated “non-protective,” is over-ventilated.

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Implementing updated ventilation standards based on new technologies, data, and knowledge could reduce total facility energy use by up to 30 percent.<sup>10</sup> Kaiser Permanente's South Bay Medical Center is the host site for the California Energy Commission's first-in-the-nation demonstration project with advanced air distribution design and sensors, “smart” building control systems, and monitoring-based commissioning that will reduce on-site natural gas consumption by 30%-50% for space conditioning and ventilation, while meeting health and safety standards for indoor air quality and reducing energy costs.

### **Case Study: VacaValley Hospital; Vacaville, CA**

In partnership with UC Davis's California Lighting Technology Center (CLTC) in 2014, VacaValley Hospital became one of the first healthcare facilities in the nation to install an energy-efficient network-adaptive outdoor lighting system. To avert energy waste, the CLTC-led retrofit installed luminaires with dimmable LED technology, motion sensors to provide maximum coverage of the site, and an “ultra-smart” lighting control network to enable facility managers to adjust lighting schedules and time-out settings, monitor energy use, and receive automated alerts when luminaires require maintenance. Metering data on the new system showed that the switch to LED luminaires reduced energy use 33.9 percent, and implementing the network control system then reduced the LED lighting's energy use 49.2 percent, saving a total of about 29,020 kilowatt-hours annually.



### *Build and Renovate Hospitals to Reduce Impact and Increase Resilience*

When a healthcare provider decides to build a new facility or to renovate older facilities, doing so in an environmentally-sound manner can lead to cost savings, reduced emissions, and a better environment for patients and staff alike. Hospitals are especially energy-intensive due to their round-the-clock hours and the nature of their work. The U.S. Department of Energy estimates that hospitals are 2.5 times more energy intensive than office buildings of similar size, producing an average of 30 pounds of CO<sub>2</sub> per square foot per year.

Health Care Without Harm's 2002–2011 pilot program, the Green Guide for Healthcare, laid the foundation for U.S. Green Building Council's LEED certification for healthcare facilities, addressing not just environmental strategies but also holistic health design issues such as increased emphasis on daylight and views, outdoor places of respite, and acoustics that benefit patients, doctors, staff, and the surrounding community.<sup>11</sup> Thanks to these efforts, LEED certification standards customized for healthcare facilities are now available, and the

energy usage reductions offered by a LEED-certified building are significant. LEED-certified buildings are estimated to reduce a facility's energy use by 25 percent, average energy bill by 19 percent, and carbon emissions by 34 percent.<sup>12</sup>

According to the California Energy Commission, California needs to make better use of locally available renewable energy to increase resiliency and address climate change impacts such as increased fires, severe storms, and heatwaves. Critical facilities, like hospitals, are especially vulnerable to climate change impacts that disrupt the normal delivery of energy needed for their operation.<sup>13</sup> Microgrids, which are attached, but able to function independently from the primary electricity grid, provide an option for hospitals to stay operational when the grid goes down. The California Energy Commission's Energy Innovation Showcase is funding a demonstration project for a renewable energy microgrid with battery storage at a Kaiser Permanente hospital.

#### **Case Study: UCSF Medical Center at Mission Bay; San Francisco, CA**

The University of California San Francisco has been investing in LEED-certified projects since 2006, and just completed a nearly decade-long \$1.5 billion expansion, with all three new facilities receiving LEED Gold accreditation.<sup>14</sup> Features of the UCSF Medical Center at Mission Bay include 4.3 acres of open space with over an acre of rooftop gardens; smart irrigation and water-saving fixtures; maximization of outdoor light and a 750-kilowatt photovoltaic system; organic, local, and fair-trade certified food purchasing; usage of non-toxic building materials and cleaning supplies; and 10 dual-charging stations for electric vehicles.

Going forward, UCSF has pledged to build all new facilities to meet a minimum Silver-level LEED certification.<sup>15</sup> The school has also put forward the robust goals of reaching its 1990 level of carbon output (which was 109, 817 metric tons of carbon when accounting for both direct and indirect emissions<sup>16</sup>) by 2020, achieving total carbon neutrality by 2025, increasing sustainable purchasing and reducing water use 36 percent by 2020.<sup>17</sup>



### Case Study: Kaiser Permanente's Richmond Medical Center; Richmond, CA

In 2016, Kaiser Permanente implemented the first renewable-based microgrid at a California hospital. Working with Charge Bliss and funded by the California Energy Commission, the project at Richmond Medical Center installed 250 kW of solar and 1 Mwh of battery storage, which will reduce utility energy usage by over 350,000 kWh per year and decrease peak monthly site demand by 100kW. The major innovation is the ability to "island" part of the site's critical load if both the grid and backup generators failed (or in the case of a prolonged emergency where fuel supplies for emergency power are cut off), to improve the energy reliability of hospital in crisis situations. Unlike backup generators, the combined solar and storage system can be used all the time, not only during power outages. The electricity generated by the solar panels reduces electricity bills by around \$140,000 and greenhouse gas emissions by about 263 MTCO<sub>2</sub>e per year.

## Invest in Renewable Energy

Hospitals are energy-intensive facilities, and while various strategies can lower their energy use, they will always use more energy than other buildings of comparable size. At present, electricity use constitutes about 38 percent of the average hospital's energy consumption.<sup>18</sup> All fossil fuel sources release CO<sub>2</sub>, sulfur dioxide (SO<sub>2</sub>), nitrogen oxide (NO<sub>x</sub>), and mercury, among other pollutants. Practice Greenhealth's [Healthcare Energy Impact Calculator](#) estimates that premature deaths, chronic bronchitis/ER visits, asthma attacks, respiratory symptoms, mercury impacts, and lost work days from healthcare's 73 billion kWh energy use cost society over \$5 billion annually and \$600 million in treatment costs.

Protecting the health of building occupants and their communities is fundamental to the mission of hospitals. In order to reduce their emissions, protect public health, and support the transition to a low-carbon economy, hospitals must install and invest in renewable energy. And while there is no question that California has taken a leading role in renewable energy generation,

opportunities to power individual facilities with renewable energy are often dependent on site location.

In late 2014, the Gunderson Health System in La Crosse, Wisconsin became the first energy-independent health system in the United States by offsetting 100 percent of its fossil fuel use with locally produced renewable energy. Many California health systems are not far behind, and as utilities develop increased renewable capacity, purchasing clean energy will become easier and less expensive. Additionally, in 2015, Governor Jerry Brown signed into law a bill requiring that state-regulated utilities generate 50 percent of California's electricity from renewable sources by 2030. California has also set relatively high thresholds for bulk energy storage capacity in the future, which will allow excess renewable energy to be stored, not curtailed, during times of overgeneration.

### Case Study: Kaiser Permanente; Oakland, CA

As the largest integrated health system in the United States, Kaiser Permanente's sustainability strategy is "intentionally ambitious" and includes becoming carbon neutral by 2020 and "carbon net positive" by 2025.<sup>19</sup> The company plans to achieve this goal largely by maximizing energy efficiency, producing 70 megawatts of solar energy at up to 100 hospitals and other facilities. Kaiser Permanente is already purchasing the output from 153 MW of off-site wind and solar projects in California, an effort that will significantly expand as Kaiser Permanente procures enough off-site renewable energy to meet 100% of its electricity demand by 2020.<sup>20</sup> In addition, Kaiser Permanente plans to purchase carbon offsets in order to reduce the direct emissions from its central utility plants, as well as take more carbon out of the air than the company produces (hence, "carbon net positive").



## Advance Alternative Means of Transportation

The more miles travelled, the more air pollution created, resulting in more asthma, heart disease, stroke, cancer, and traffic-related morbidity and mortality in our communities and regions.<sup>21</sup> Transportation is the largest contributor of greenhouse gas emissions in the state of California and is responsible for 160 million metric tons of CO<sub>2</sub> per year, or 37 percent of the state's total, according to the 2015 California greenhouse gas emissions inventory.<sup>22</sup> As major employers in the state, and because of their complex supply chain logistics, hospitals are well-positioned to reduce transportation GHGs by influencing employee commuting behaviors, transitioning to low- or zero-emission fleet vehicles, and scrutinizing supply chain distribution practices.

Hospitals can support their employees in using less carbon-intensive transportation options through a variety of strategies: free or subsidized public transit passes, parking fees, bike racks and showers, electric vehicle charging stations and discount programs, tax deferral programs for commute expenses, a daily stipend for those who do not drive alone to work, and bike, car, and rideshare services with an emergency ride home provision. Transitioning fleet vehicles away from conventional fossil fuels beginning with diesel

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-- the worst offender in terms of hazardous airborne particulate matter and soot -- toward low/zero-emission, fuel-efficient, and alternative fuel vehicles is a key strategy for reducing air pollution. Understanding how distributors, suppliers, carriers, and service providers move hospital materials can lead to emissions reduction and cost-saving opportunities with a transition to efficient transportation practices.<sup>23</sup>

Governor Jerry Brown's plan to get 5 million zero-emission cars on the road by 2030, announced in January 2018, should also help the healthcare sector achieve emissions reductions. The plan will dramatically increase the number of charging stations being built, and it will continue to provide consumers with rebates for purchasing zero-emission vehicles.<sup>24</sup>

### Case Study: University of California San Francisco (UCSF); San Francisco, CA

The University of California San Francisco is the second largest employer in the city of San Francisco, with 24,143 employees<sup>25</sup> and more than 5,785 students, residents, and postdoctoral scholars.<sup>26</sup> UCSF has a strong commitment to reducing its commute carbon footprint and has been nationally recognized for its work in transportation, receiving "Best Workplace for Commuters" awards three times between 2009 and 2017 from the National Center for Transit Research.<sup>27</sup>

UCSF offers its staff, faculty, and students a wide variety of alternative transportation options and commuter benefits that reduce commuter-related greenhouse gas emissions, traffic, and parking congestion. UCSF recently purchased two electric vans and 15 electric buses and has installed 38 electric vehicle charging stations across the campus. There are also 3 large bicycle cages and bike racks that service close to 900 people with available shower facilities. Close to 20% of its commuter population drive hybrid or all-electric vehicles. UCSF has reduced its single occupancy vehicle (SOV) rate to 28% in FY17, one of the lowest in the 10-campus UC System.

### Procure and Serve Healthy and Sustainable Meals

Healthy and sustainable meal options are important for both patient and environmental health. Americans eat more than twice the global average of meat, and red meat consumption has been associated with an increased risk for heart disease, stroke, Type 2 diabetes, certain types of cancer (most notably colorectal), and all-cause mortality. Globally, an estimated 14.5 percent of global greenhouse gas emissions comes from the livestock sector alone, according to the Food and Agriculture Organization of the United Nations.<sup>29</sup> Due to meat's carbon-intensive production, simply moving from a diet "heavy" in meat to a diet "low" in meat can reduce an individual's carbon footprint by a third in a single step.<sup>30</sup>

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*Globally, an estimated 14.5 percent of global greenhouse gas emissions comes from the livestock sector alone.*

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Transitioning to diets with more plant-based ingredients is an essential action to promote long-term environmental sustainability. Hospitals can leverage behavioral change campaigns aimed at reducing the demand for livestock production like Health Care Without Harm's [Less Meat, Better Meat Campaign](#) for the healthcare sector. Strategies that California hospitals are using for making this shift include "blending" sustainably-raised meat with plant-based proteins such as mushrooms or legumes, substituting meat completely with plant-based options, and decreasing portion sizes. In addition to serving less meat, hospitals can use their significant purchasing power to support local, sustainable vendors who use less water- and chemical-intensive farming practices. In addition to reducing their carbon footprint, a hospital's purchase of local, sustainable food helps increase the availability of healthy food in the community and supports a strong regional food economy.

### Case Study: Palomar Health; Escondido, CA

Palomar Health made a formal commitment to plant-based eating and sees healthy eating as a foundation of vitality that is central to its mission to heal, comfort, and promote health in the community it serves. Palomar Health's food service team has implemented this commitment by replacing "traditional center-of-the-plate meat" with plant-based food in 60 percent of its menus, and the system has made particular strides with respect to food sustainability in its facilities.<sup>31</sup> Palomar Health also reduces the carbon impact from its food service through its purchases of sustainable, local (within a 250-mile radius), organic food, also known as SLO produce. As of 2016, SLO produce made up more than half of all food purchases at two Palomar Health campuses, Escondido and Ponway.<sup>32</sup>

## Reduce Waste, Divert from Landfills

U.S. hospitals create about 7,000 tons of waste per day, which equals about 29 pounds of waste per day per patient, and the environmental footprint of that waste is much larger than just its disposal impact.<sup>33</sup> The manufacturing process and transportation of the products purchased by U.S. hospitals also creates 32 pounds of waste for every pound of product manufactured.<sup>34</sup>

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Non-regulated waste (which is no different from normal, non-medical waste) constitutes approximately 85 percent of a hospital's overall waste stream,<sup>35</sup> and about 60 percent of it is either recyclable or compostable. Regulated medical waste can make up 15–20 percent of hospital waste, and chemical waste typically constitutes less than 5 percent.<sup>36</sup> Reducing, reusing, recycling and composting non-hazardous and non-medical waste can go a long way toward improving sustainability performance. Responding to a Less Waste Challenge

sponsored by Practice Greenhealth, some health systems have succeeded in recycling more than 40 percent of their total waste and reducing regulated medical waste below 10 percent.<sup>37</sup> Key opportunities for waste reduction and cost savings in hospitals can be found in operating rooms, where surgical kits can be reconfigured to remove unnecessary items, single-use device reprocessing programs can be implemented, and reusable cases can be purchased for sterilization.

The U.S. Environmental Protection Agency estimates that about 31 percent of the U.S. food supply is wasted and that about 95 percent of the wasted food ends up in landfills or combustion facilities.<sup>38</sup> Wasted food that breaks down in landfills produces methane (a greenhouse gas that is much more potent than carbon dioxide), contributing to the 18 percent of total U.S. methane emissions that comes from landfills.<sup>39</sup> It is estimated that 10–15 percent of the total waste generated daily by a hospital is food waste, amounting to about 3 pounds per bed per day, so reducing food waste offers hospitals important opportunities for reducing emissions as well as contributing to the reduction of food insecurity.<sup>40</sup> Hospitals can reduce food waste through a variety of strategies including training kitchen staff in waste-reducing food preparation techniques, switching to a “room service” model for patient meals, donating to local food pantries, repurposing leftovers (e.g. leftover vegetables get made into soups), and diverting food waste from landfills for animal feeding or composting.

### Case Study: UC San Diego Health; San Diego, CA

Switching to a room service model in hospitals, where patients order what they want when they want (within dietary restrictions), not only increases patient satisfaction but also decreases food waste and costs. In 2016, UCSD Health Nutrition Services compared food waste generated from room service operations at Thornton Hospital to their cook-chill operation at Hillcrest Hospital. They found that food waste per patient tray was 66% less with room service compared to the food waste generated when food is prepared, frozen, and reheated for patients. When room service is fully implemented at Hillcrest Hospital in 2018, UCSD projects it will reduce food waste generated by 53,988 pounds and save approximately \$50,000. UCSD will have happier, healthier patients and at the same time reduce greenhouse gas emissions by 147 MTCO<sub>2</sub>e, equivalent to taking 31 cars off the road.



## Source Environmentally Preferable, Low-Carbon Products

A hospital's mission is to protect and heal, but every year, the healthcare sector spends hundreds of billions of dollars on medical products that have significant environmental and health impacts. The National Health Service (NHS), the publicly funded national healthcare system for England that has been tracking and trying to reduce its carbon footprint since 2008, reports that carbon embedded in goods and services purchased by the NHS contributed 57% of its carbon footprint in 2015.<sup>41</sup> With California's healthcare expenditures estimated in 2014 to be about \$7,549 per capita,<sup>42</sup> the state's healthcare sector can be a significant positive force for change when purchasing sustainable, low-carbon products.

Hospitals can use Practice Greenhealth's [Standardized Environmental Questions for Medical Products](#), to identify environmentally preferable products, which have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. Hospitals can also ask their Group Purchasing Organizations to support their sustainable procurement efforts by contracting for and clearly designating environmentally preferable products. In 2016, Practice Greenhealth, Health Care Without Harm, and leading health systems launched Greenhealth Exchange, a public benefits corporation purchasing cooperative which specifies, screens, and sources high-quality green products for the healthcare sector.

Dignity Health was a founder of [Greenhealth Exchange](#) and the health system's guiding principle, "what's good for the patient is good for the planet," has positioned them as a leader in the transition to safer,

less toxic products. In 2005, Dignity Health eliminated the use of polyvinyl chloride (PVC)/ di-2-ethylhexyl phthalate (DEHP) from intravenous (IV) bags, solutions, and tubing to prevent DEHP after it was found that DEHP was leaching into IV solutions and had negative health impacts. In 2012, Dignity Health became the first healthcare system in the nation to begin using pigment-free patient plastics, which eliminates the need for potentially harmful chemicals during the manufacturing process and prevents pigment from leaching into the soil and groundwater.

Kaiser Permanente, with its mission of improving the health of its members and the communities it serves, is a national leader in environmentally preferable purchasing (EPP) in healthcare. It launched its first Sustainability Scorecard, the first of its kind in the sector, in 2010. Kaiser Permanente's procurement team remains committed to applying EPP guidelines and specifications to all major, strategic, and critical purchasing decisions, and implemented its rigorous [Environmentally Preferable Purchasing Standard](#) in 2017. The EPP Standard mandates specific environmental criteria in the areas of chemicals and waste be met in purchasing decisions (in addition to other criteria), and that current and prospective suppliers of products comply with the standard. The EPP Standard ties into Kaiser Permanente's 2025 Environmental Stewardship goals of recycling, reusing or composting 100% of its non-hazardous waste, and increasing its purchase of products and materials meeting environmental standards to 50%. To read Kaiser Permanente case studies on over 50 EPP product areas, visit the [Practice Greenhealth EPP Case Studies in Health Care](#).

### Case Study: Dignity Health; San Francisco, CA

Reprocessing single-use devices is a climate-smart practice that not only radically reduces medical waste, but also significantly reduces supply costs. Dignity Health has an exemplary reprocessing program that maximizes both the collection and purchase of reprocessed devices. In 2017, Dignity Health saved over \$10 million and eliminated more than 371,000 pounds of medical waste by reprocessing SUDs. Over the last four years, Dignity Health has saved more than \$31 million and eliminated more than 1.4 million pounds of medical waste from our nation's landfills. To implement a successful reprocessing program, it is critical that all staff members – including surgeons – are educated about the benefits, science, safety, and technology of reprocessing. Other keys to Dignity Health's success include executive support, monthly compliance reporting, and procurement staff oversight to prevent OEM interference. To learn more about how Dignity Health implemented this program, [see their earlier case study](#).

## Conserve Water

Hospitals are ranked as the third most water-intensive public buildings (after senior care facilities and hotels), using an average of 570 gallons per staffed bed per day.<sup>43</sup> Water is also a major contributor to greenhouse gas emissions because of the energy consumption related to distribution and treatment. In drought-prone California, water conservation is an essential component to climate-smart practices. By far, the majority of potable water consumption in hospitals is for process uses – that is, for mechanical systems, kitchen and sterilization uses. However, due to unique health and safety concerns, conserving potable water in hospitals is more challenging than in other commercial buildings. Challenges range from concerns about reducing water flow in plumbing fixtures through aeration, which may allow for increased bacterial pathogens, to water reuse through greywater or blackwater systems (for example, treating on-site and recirculating toilet conveyance water), to storing large amounts of rainwater. Finding uses for such water supplies that limit direct contact with building users is an important consideration.

Despite the limitations, many hospital systems are taking the initiative to conserve water, using strategies such as rainwater harvesting, low-flow sinks and toilets, grey water re-use, and sustainable management of their landscaping. For many hospitals, water conservation measures begin with water audits and can yield impressive reductions: Providence St. Peter, in Olympia, WA, reduced potable water consumption by 60% over a 10-year period through fixture retrofits, kitchen and sterilization equipment replacement, and fixing leaks.<sup>44</sup>

## Engage in Policy

In order to successfully build a climate-smart healthcare system in California, healthcare leaders must not only implement climate-smart initiatives inside their facilities, but also engage in climate and energy policy. Federal, state, and municipal standards determine what can be done when it comes to institutional and community infrastructure, transportation, and resilience. Departments of public utilities, energy grid rules, programs, and market structures impact energy options. Recognizing this, it is imperative for healthcare sector leaders to educate policymakers and regulators about the connection between climate-smart policies, public health, and controlling healthcare costs.<sup>46</sup>

Dignity Health has been active in climate and energy policy for over 20 years, viewing it as a moral and strategic business imperative. Dignity Health helped to secure passage of SB 350, the Clean Energy and Pollution Reduction Act, California's landmark 2015 legislation establishing new clean energy, clean air, and greenhouse gas reduction goals, through press conferences, op-eds, testimonies, legislative visits, and hosting events with other businesses and NGOs. Dignity Health is currently advocating for the passage of SB100, which sets a 100% clean, zero carbon, and renewable energy policy for California's electricity system by 2045.

### Case Study: Lucile Packard Children's Hospital; Palo Alto, CA

The major addition at Lucile Packard Children's Hospital Stanford in Palo Alto, California opened in December 2017. The facility has been designed to reduce water consumption by 38 percent through a combination of water-saving fixtures and natural landscaping. The 521,000-square foot facility, located in an arid climate with limited and seasonal rainfall, includes 3.5 acres of gardens, advanced ventilation systems and strategic shading for energy reduction, and an extensive and innovative water reclamation system. Two underground cisterns hold 110,000 gallons of rainwater, condensate from air handling units, and reject water from hemodialysis to avoid 700,000 gallons of potable water use in landscaping each year.





## Sector and Policy Recommendations:

The below list of recommendations was developed with the intention of guiding concerted private and public-sector action. To make the healthcare sector more sustainable, it will require significant coordination between the healthcare sector, its upstream and downstream suppliers, and policymakers on a local, state, and national level.

### Sector Recommendations

**Perform energy audits of facilities and implement a continuous commissioning program to reduce energy consumption.** Operating buildings as designed and immediately addressing suboptimal conditions and settings presents an opportunity to reduce GHG emissions while positively impacting the bottom line. A continuous commissioning capability that combines real-time fault detection with algorithms that identify high payback actions will quickly resolve operating problems, improve comfort, and optimize energy use.

**Invest in renewable energy.** The combustion of fossil fuels leads to significant adverse health impacts and hospitals have the responsibility to protect public health. Renewable energy sources are becoming cost competitive with fossil fuels and eliminate the risks of energy cost volatility. California has strong policy support and incentives for on-site and off-site investments in renewable energy.

**Advance the transition to a low-carbon transportation system for cleaner air and healthier communities.**

Hospitals should follow a four-pronged approach:

- A. Incentivize alternative transportation modes for employees.
- B. Convert fleet vehicles to low/zero emission fuels.
- C. Provide electric vehicle (EV) charging infrastructure.
- D. Address supply chain impacts through adopting idle-reduction practices, consolidating deliveries, and incorporating EPA SmartWay criteria in vendor selection.

**Purchase local and sustainably-grown and produced food** to reduce climate impacts from industrial agriculture production methods and to support the growth of a strong, regional food economy. As large-volume buyers, hospitals can make purchasing commitments to local producers that allow them to expand operations and invest in new processing equipment. Hospitals should instruct their GPOs to source local food and ensure it is clearly labeled as such in catalogs and ordering forms.

**Focus on waste reduction** as the key strategy to reduce environmental impact and associated costs. Look for opportunities to switch from disposable to reusable options across the system – sharps containers, sterilization cases, totes, isolation gowns. Reduce pre- and post-consumer food waste for savings on food purchases and significant GHG emissions reduction. Regular staff training on waste segregation is critical for success.

**Implement an environmentally preferable purchasing policy** and embed environmental attribute considerations in purchasing standards, specifications, decisions, contracting, and requests for proposal (RFP) to prioritize environmentally preferable, low-carbon products and services.

**Conserve water** and save money on water and sewer bills. Start with a water audit to analyze the facility for leaks and identify opportunities to:

- A. Save water in facilities (e.g. maintain boiler steam traps, capture condensate on cooling towers).
- B. Install water-efficient equipment (e.g. low-flow, sensor-activated faucets).
- C. Reduce water use for irrigation (e.g. xeriscape landscaping, rainwater collection).

**Advocate for climate-smart public policies.** Use healthcare's trusted voice to educate policymakers and the public that strong climate mitigation and resilience policies are good for both public health and the control of health care costs.



## Policy Recommendations

**Adopt energy-saving opportunities from national standards into California code.** For some years, California requirements for healthcare infrastructure – largely set by the Office of Statewide Health Planning and Development (OSHPD) – have been substantially more restrictive than national and other state standards. National standards contain a number of opportunities for energy savings, which should be adopted into California codes and that should be considered.

— **Develop a leadership position in energy-conscious health care ventilation through pilot projects and research.** Hospital ventilation standards present a significant opportunity for energy and carbon reduction and current California standards exceed national requirements. The California Energy Commission (CEC) has begun an advanced HVAC demonstration project, and should expand this opportunity, taking a role of national leadership in introducing new technology into the national standards paradigm.

**Design streamlined approval processes for proven technologies that have demonstrated significant energy-savings.** The time and money imposed by permitting is significant and makes it difficult for hospitals, especially smaller hospitals, to do even simple energy-saving upgrades like LED retrofitting. Streamlined approvals processes should be implemented for projects such as LED retrofitting, the conversion of exhaust fans to low voltage units, the replacement of inefficient motors with efficient ones, and the replacement of water savings devices.

**Create an advocate in the Attorney General's Office for enforcement of the Solar Rights Act (Code 658).** The Solar Rights Act is largely ignored by municipalities and many health systems have had significant pushback when trying to install solar projects. Health systems are unlikely to complain to a municipality for fear of repercussions. A Solar Rights Act Advocate to whom developers and customers could file complaints could facilitate the installation of additional solar at an increased pace.

**Maintain and scale state support for the Self-Generation Incentive Program (SGIP).** This program makes it economically viable for health systems to install battery storage, and these rebates should be maintained until large-scale battery storage becomes more competitive.

**Continue state funding to support the transition to electric vehicles and renewable fuels,** particularly for development of needed infrastructure. Include social equity measures to promote access to alternative transportation and vocational opportunities related to new transit technologies.

**Create policy incentives to support shifts toward reduced meat and dairy production and consumption.** Examples include: increasing research and support for transitioning animal agriculture farms to integrated systems or to the production of nitrogen-fixing protein alternatives such as organic legumes, or implementing carbon tax policies that account for livestock emissions.

**Adopt farmland conservation efforts** that include access and affordability strategies, to not only protect farmland, but to protect the benefits that the state's small-scale, sustainable farmers provide and to ensure their livelihoods.

**Examine ways to encourage municipalities – especially medium and small municipalities – to commit to Zero Waste Principles.** The majority of hospital waste is non-regulated and is therefore handled by municipal providers just like residential waste. Several major California cities, including San Francisco and Los Angeles, have committed to Zero Waste Principles in cooperation with refuse and recycling service providers. Structures to encourage and even incentivize smaller municipalities to commit to Zero Waste could go a long way in reducing a hospital's footprint.

**Support a sustainable water supply** through conservation, efficiency, and infrastructure maintenance. Ensure full implementation of the Sustainable Groundwater Management Act. Provide adequate funding for smart water management projects and programs, including funds to provide safe and affordable drinking water to all Californians.

## End Notes

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